

WASHINGTON

SCIENCE TRENDS

HIGHLIGHTS

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* PROGRESS ON JP-4 FUEL CONTAMINATION

The military services continue their efforts to assure clean and dry fuel for aviation purposes. Further research is still required. (See, for example QMC Problem 16, Page 74). Here is a summary of recent Army and Air Force progress in this technical area, as reported by the U. S. Army Board for Aviation Accident Research.

✓ Army Engineers have completed design of improved fixed petroleum storage and dispensing facilities for Army airfields.

✓ Action has been initiated to develop a family of military filter/separators for use with handpumps, mobile refuelers and at fixed installations. These are expected eventually to replace qualified commercial type units. In addition, new military specifications for various types of filter/separator equipment, are more rigid than in the past.

✓ Army Engineers have signed a contract with the Armour Research Foundation, Chicago, Ill. to develop improved filtration media for future use, if cleanliness requirements for aviation fuels become more critical.

✓ Army Ordnance wants to see the development of an improved interior lining for tank refuelers, resistant to aviation fuels and water. Better linings for tank trucks, it is believed, will reduce the amount of rust and scale.

✓ Army Ordnance is also conducting engineering tests on a newly developed fibre-glass-reinforced plastic tank for use on fuel servicing tank trucks. This use of plastic is expected to eliminate maintenance and contamination problems associated with corrosion of steel fuel tanks.

✓ Army Quartermaster Corps is now periodically testing samples of the effluent stream of all aviation fuel filter/separators. Sample containers and instructions for taking samples are furnished to all Army airfields by designated QM petroleum laboratories. In addition, aviation units will receive so-called "Hydro-Kits" consisting of small vial type fuel testers and chemicals for checking water content of JP-4 fuels during preflight inspections.

✓ An anti-icing additive for JP-4 fuel, developed by the Phillips Petroleum Co. has passed Air Force tests and will be jointly procured by the military services.

✓ Army Quartermaster Corps has initiated a development project for an effluent stream tester. The successful completion of this project will provide additional assurance that only clean and water-free fuel enters the aircraft. The lightweight tester will automatically terminate flow fuel when sedimentation or free water is detected.

* ARMY RESEARCH PROBLEMS

Here is a selected compilation of current unsolved problems in research and development as outlined by the Army's Quartermaster Corps. The Army states that proposed solutions to these problems are welcomed from industry, universities and other nonprofit institutions, and private citizens.

Proposed solutions, or inquiries, should be directed to:

The Commanding General
Quartermaster Research and Engineering Command
U. S. Army
Natick, Mass.

- QMC - 1 -- Develop device(s) and improved techniques for airdropping equipment loads, ranging in weight from 2,000 pounds to 30,000 pounds. (Effective air delivery systems require a means for airdropping loads at a rate of descent of 25 to 50 feet per second. The performance of the device must be at least equal to that of currently used devices (parachutes and platforms) in reliability, rate of descent, simplicity, weight, bulk, and in addition should provide more economical operations.)
- QMC - 2 -- Develop a predictable variable crushing force impact energy dissipator. (In order to prevent damage to military supplies and equipment which are airdropped, it is necessary to dissipate the kinetic energy of airdropped loads during ground landing impact. Present techniques employ paper honeycomb which is crushed and expanded on use. Commercial paper honeycomb costs about 65 cents per cubic foot, develops about 6,000 pounds per square foot deceleration force level in crushing under dynamic load, and has about 70% volumetric efficiency. Some other material or a single device is needed which, in addition to being highly efficient as an energy dissipator, will also permit reliable and accurate adjustment to a desired deceleration force level throughout an equivalent range of from 25 to 150 pounds per square inch. It should be capable of re-use or be competitive in cost with paper honeycomb if not reusable.)
- QMC - 4 -- Develop a family of low-cost cargo parachutes. (Re-usable parachutes which are presently utilized for airdropping supplies and equipment have an initial high cost and also require recovery, transport, repair, inspection, and repacking. Low cost and reliable parachutes are needed to further reduce the present cost and manpower requirements for airdropping military supplies and equipment.)
- QMC - 6 -- Develop a troop-type parachute harness, capable of being removed immediately upon landing. (At present, the parachutist can divest himself quickly from only his main parachute canopy. His harness, reserve parachute, and combat equipment remain on his person. This is particularly hazardous if a parachutist lands in high winds or in water. A harness is needed which permits a parachutist to quickly divest himself of his complete parachute assembly and all equipment attached thereto, immediately upon landing.)
- QMC - 7 -- Develop a low-altitude air delivery system to deliver heavy military equipment and supplies from altitudes of 300 to 800 feet. (Present systems involve air delivery from 1,000 to 1,500 foot altitudes, with resultant exposure to enemy detection. Ability to deliver from 300 to 800 feet will provide a greater degree of accuracy and minimize chances of enemy action.)
- QMC - 15 -- Develop a device for anchoring guy lines, for use in ice or frozen ground. (There is a need for a device that will permit anchoring of guy wires in ice or cold hard ground. It must be quick and simple to install and remove.)

* ARMY RESEARCH PROBLEMS (Continued)

- QMC - 5 -- Develop an air drop load locating-identifying system composed of nonelectronic and noninfrared devices which will enable rapid and reliable location and identification of airdropped supplies and equipment during the recovery phase of an airborne operation. (Inability to rapidly locate and positively identify airdropped loads because of unfavorable terrain, inclement weather, night operations, and multiplicity of similar items on the drop zone results in loss of equipment. A nonelectric, noninfrared locator/identifier dual-purpose system is required by Army field units dependent upon airdropped supplies and equipment to improve their combat and operational effectiveness by permitting each organizational element to locate and identify property more rapidly on the drop zone. Approaches which will be considered are systems composed of mechanical sound devices, self-contained light sources (other than infrared), in conjunction with reflectors or the like, coded sounds (other than radio), coded lights (different colors or number of flashes, etc.), luminescent, color coded, pressure-sensitive, precoated adhesive-backed tapes, patches, etc.)
- QMC - 8 -- Develop improved field laundry equipment. (Present field laundry equipment requires a generous supply of water and liquid fuel. New military concepts visualize equipment which reduces fuel requirements and utilizes little or no water; does not increase the logistical requirements for soaps and/or detergents; and is comparable in space, weight, and complexity with conventional field laundry equipment.)
- QMC - 11 -- Develop tent heaters and field cooking equipment which safely and efficiently convert the potential energy of light petroleum products performed by other than a high-temperature flame. (Present tent heaters and field cooking equipment, which are gasoline burning, constitute a fire hazard, and compromise blackout conditions. Improved methods for burning liquid petroleum products without visible flame or smoke are needed which are comparable in simplicity, weight, size, and portability to conventional portable cooking and heating field equipment.)
- QMC - 12 -- Develop a charcoal-slat fuel unit for rapidly heating individual rations to a palatable temperature under freezing conditions without scorching viscous foods. (A chemical fuel tablet (trioxane) which is ignited and used to heat a can of footstuff at the bottom is the current standard item for heating rations in the field. A charcoal-slat fuel unit that fits around the periphery of a can shows promise for heating viscous foods. The rate of heat delivery must be high enough to accomplish the heating in 10-15 minutes. Good performance under adverse weather conditions, simplicity of operation, and low luminosity, bulk, weight, cost, and availability of the item are important.)
- QMC - 14 -- Develop an efficient, compact, light, quiet power source. (Existing sources, such as batteries, require frequent charging or, in the case of throw-aways, heavy logistic support. They are also too heavy for many uses. Internal combustion engines are, in general, too noisy for front line operations. The recently announced solar and atomic batteries are still in the developmental stage and are not suited to field application at present. An efficient, compact, light, quiet power source is needed for mobile and man-portable field applications.)
- QMC - 24 -- Develop chemical repellents and physical barriers for the protection of materiel against rodent damage. (Relatively few useful rodent repellents are known. Those which have shown promise are being tested for effectiveness in the field. There is a need for a non-toxic, inexpensive chemical which can be applied to subsistence packaging to prevent rodent damage. There is also a need for rodent-proof packaging materials.)

* ARMY RESEARCH PROBLEMS (Continued)

- QMC - 16 -- Devise a fuel contaminant sensing and separating device. (Conventional fuel filters are used to remove contaminants from fuel; however, an automatic positive means of preventing the inadvertent release of contaminated fuel into aircraft fuel tanks does not exist. In order to provide the high quality fuels needed for military operations, a device capable of automatically and positively sensing the presence of contamination and diverting or cutting off the refueling stream is needed. Currently published military standards prescribe the contamination limits applicable to the development of this item.)
- QMC - 17 -- Develop a portable device, or system, which has the capacity of pipelines and the mobility of cargo vehicles for transporting and delivering bulk petroleum, oil, and lubricant (POL) products, required to support dispersed field armies. (There is a requirement for a lightweight, reliable, collapsible, and portable means for distributing fuel in communication and combat zones. The item should be so designed that it could be made available in unlimited lengths, capable of rapid deployment from moving vehicles and aircraft, in quantities up to 600 gallons per minute at operating pressures up to 150 pounds per square inch.

Several approaches to this problem have been considered. Lightweight materials, such as plastics and aluminum, are available and considered potentially adaptable. Design concepts are needed for a lightweight system, or item, which has low transport volume; will minimize maintenance requirements; and may be used under global environmental conditions, including subzero temperatures and other climatic extremes.)

- QMC - 21 -- Develop lightweight flexible or semi-flexible package for pre-cooked and uncooked dehydrated foods. (The basic package now employed is a bag constructed from a vinyl-foil-polyester film which is placed in a chipboard carton. In the case of quick-serve meal components, the carton design allows for the additional volume of water needed for reconstitution. It is necessary to use a full vacuum pack or a combination vacuum and gas pack to provide a stable package atmosphere consistent with the hazards of air shipments at high altitudes. It is further necessary to take additional measures such as using a heavy inner bag to protect the primary package from damage by food characterized by very rough jagged particles. Studies are in progress to improve not only the basic package now used but to develop new concepts. The experience and developments by the manufacturers of practically all types of containers can be of use in the solution of this problem. Any feasible solution to the overall problem or parts of it will be of interest.)
- QMC - 22 -- Develop flexible packages for heat-processed foods. (All heat-sterilized foods are now packaged in conventional metal cans which have appreciable weight and are wasteful of space in the round shape. Studies are in progress to develop a package resistant to heat-processing and having as near as possible the same storage and handling characteristics as a metal can. The package must be compatible with the food when processed at temperatures as high as 250° F. and retain compatibility for long storage periods. It must be capable of withstanding the physical handling to which it would be exposed when carried in the pocket of a combat soldier. The actual packaging problem, a processing problem, mainly mechanical in nature, is apparent. The present problem is how to process individual flexible packages in commercial retorts and have processing uniformity. It is known that various industrial and educational organizations are interested in this problem. Any information they may extend would be appreciated. Further, information concerning new packages possessing the listed attributes to the greatest possible degree will be of interest.)

(To be continued)

RESEARCH CHECKLIST

- CORROSION RESEARCH: Studies by the National Bureau of Standards have provided new basic data on the mechanisms involved in the corrosion of metals. In one recent investigation of the thin oxide films that sometimes form on metal surfaces during the corrosion process, the growth rate of such films was measured on copper single crystals exposed to varying amounts of oxygen in water. It was found that the type of oxide formed and its thermodynamic stability are directly related to the amount of oxygen present.

(For further information on "Growth Rate of Oxide Films on Copper" write National Bureau of Standards, Office of Technical Information, Washington 25, D. C.)

- SPUTTERING ON THE MOON?: Studies for the Air Force by General Mills Mechanical Division on the sputtering of various materials has also led to a conclusion, based on some experiments, that the surface of the moon consists of a porous but rather solid surface. Researchers believe that about 40 meters of material should have been sputtered in 109 years under solar wind bombardment. The surface of the moon, it is stated, has been modified by this action in that loose dust particles have been fused together by sputtered atoms.

(Details are now available in Report AFCRL-TR-60-41 ((PB 171 513)) available through military channels or at \$2 from OTS, U. S. Department of Commerce, Washington 25, D. C.)

- LABORATORY-SCALE FURNACE: The Bureau of Mines has developed a laboratory furnace for high melting point metals. Castings of various reactive and refractory metals, as well as castings of iron, chromium and copper have been produced. The Bureau believes that the equipment should be particularly useful for producing metallurgical specimens where homogeneity in cast material would be beneficial and adds: "As many industrial and college laboratories have or plan to install cold-mold arc furnaces, the fact that the casting equipment can be only a modification of a conventional furnace is a definite advantage."

(Details available in Report of Investigation No. 5726. Single Copies Free from U. S. Bureau of Mines, 4800 Forbes Avenue, Pittsburgh 13, Pa.)

- EMERGENCY NEUTRON DOSIMETER: The Atomic Energy Commission has released details of a small, low-cost criticality monitoring device designed to measure the neutron and gamma exposures that might be received by personnel involved in a nuclear accident. The pencil-shaped "Emergency Neutron Dosimeter" was developed by du Pont Co., Savannah River Laboratory, Aiken, South Carolina. The device, estimated to cost \$5, measures neutron exposures greater than about 1 rad by activation analysis of various neutron-sensitive materials. The dosimeter also includes an element to measure gamma exposures above 50 r.

(AEC Report DP-472. 29 Pages. Available through AEC channels or at 75 cents from OTS, U. S. Department of Commerce, Washington 25, D. C.)

- IMPROVED SOLID-STATE FISSION PROBE: Studies by the National Aeronautics and Space Administration indicate that large area semiconductor fission detectors can be fabricated by placing silicon p-n junction wafers in series. This approach, while relatively simple, is said to fill the present need of the space agency for a small compact fission probe with a reasonably high sensitivity.

(For further details see NASA Technical Note D-1054 available from National Aeronautics and Space Administration, ATTN: CODE BID, Washington 25, D. C.)

P U B L I C A T I O N C H E C K L I S T

All of the following publications are now available, at the prices indicated, from the Superintendent of Documents, Government Printing Office, Washington 25, D. C. When ordering, be sure to include the correct publication number.

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- ☐ TEACHING BY MACHINE, a collection of information on machine systems, types of teaching machines, programming, etc. 173 Pages. 65 cents. (Order FS 5.234:34010)
- ☐ SAMPLING DUST FROM THE STRATOSPHERE, a technical count of Air Force sponsored research using B-52 and U-2 aircraft for the collection of airborne particles. Studies are continuing "by means of aircraft flying to altitudes of 85,000 feet or better." 10 Pages. 20 cents. (Order SI 1.12/2:5/10)
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